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John L. Rogitz
Rogitz & Associates
Suite 3120
750 B Street
San Diego, CA 92101

EXAMINER	
WILLHITE, TYLER C	

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2189	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/674,081	NEW ET AL.	
	Examiner	Art Unit	
	Tyler Willhite	2189	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 September 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *9/29/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement filed 29 September 2003 is in compliance and has been considered by the examiner.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the RAID system and RAID controller as recited in claims 9 and 17-25 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner,

the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities: grammatical errors.

Line 20 of page 2 (the last line of page 2) of the specification is word for word the same as line 1 of page 3. One of the redundant lines should be deleted to maintain proper grammatical form.

Appropriate correction is required.

3. The disclosure is objected to because of the following informalities: heading for the claims misplaced in the specification.

Line 12 of page 12 of the specification includes the heading for a set of claims "WE CLAIM:". This heading is improperly placed and should be removed from the specification as the claims are to commence on a separate sheet of paper from any other portion of the disclosure. See 37 C.F.R. 1.75 (h).

Appropriate correction is required.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct

from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-4, 10, and 18 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2, 4, and 9 of copending Application No. 10/674093 (hereafter '093). Although the conflicting claims are not identical, they are not patentably distinct from each other because the copending claims anticipate the instant claims. A later patent claim is not patentably distinct from an earlier patent claim if the later claim is obvious over, or anticipated by, the earlier claim. In re Longi, 759 F.2d at 896, 225 USPQ at 651 (affirming a holding of obviousness-type double patenting because the claims at issue were obvious over claims in four prior art patents); In re Berg, 140 F.3d at 1437, 46 USPQ2d at 1233 (Fed. Cir. 1998) (affirming a holding of obviousness-type double patenting where a patent application claim to a genus is anticipated by a patent claim to a species within that genus). ELI LILLY AND COMPANY v BARR LABORATORIES, INC., United States Court of Appeals for the Federal Circuit, ON PETITION FOR REHEARING EN BANC (DECIDED: May 30, 2001).

3. Claims 1-4 and 10 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 2, 4, and 9 of copending Application No. '093 in view of Rosenblum et al. ("The Design and Implementation of a Log-Structured File System", 1992, hereafter Rosenblum).

This is a provisional obviousness-type double patenting rejection.

4. Claims 1, 2, 4, and 9 of '093 show all the limitations of claims 1, 2, 3, 4, and 10 of the instant application except a log-structure file-system for storing files in segments on a disk.

Rosenblum shows a log-structured file system (page 3, left hand column, lines 36-41 through right hand column, lines 1-2) wherein the file system defines segments for writing groupings of sequential data (page 4, right hand column, lines 14-19).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the log-structured file system of Rosenblum in the disk storage system of '093 such that each file is stored in a segment in order to achieve faster file writing and crash recovery (page 1, left hand column, lines 4-7 and page 9, right hand column, lines 14-30).

5. Claim 18 is provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 9 of copending Application No. '093 in view of Rosenblum and Holland et al. (US Pat. 5,367,669, hereafter Holland).

This is a provisional obviousness-type double patenting rejection.

6. Claim 9 of '093 shows all the limitations of claim 18 of the instant application except a log-structure file-system for storing files and a RAID system with a RAID controller coupled to each disk.

Rosenblum shows a log-structured file system for storing files (page 3, left hand column, lines 36-41 through right hand column, lines 1-2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the log-structured file system of Rosenblum in the disk storage system of '093 in order to achieve faster file writing and crash recovery (page 1, left hand column, lines 4-7 and page 9, right hand column, lines 14-30).

Holland shows a RAID system including a RAID means for controlling (RAID controller **8**) (figure 1 and column 2, lines 66-68 through column 3, lines 1-6) and a plurality of hard disk drives (hard disk drive array) with the RAID controller being coupled to each of the disk drives (figure 1 and column 2, lines 43-51).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a RAID means for controlling and RAID system as taught by Holland using the disk system taught by the combination of claim 9 of '093 and Rosenblum in the RAID configuration in order to enable recovery of information stored on a disk in the event of a disk drive failure (column 1, lines 29-31).

Claim Objections

7. Claim 19 is objected to because of the following informalities: improper claim dependency. Appropriate correction is required.

On line 1 of claim 19, the preamble of claim 19 reads as "The RAID system of Claim 19...". A claim cannot depend from itself, so the preamble of claim 19 should be rewritten from "The RAID system of Claim 19..." to "The RAID system of Claim 18..." as, for the purposes of this examination, the examiner assumes that claim 18 is the intended parent claim of claim 19 based on the ordering of the claims and the limitations of claim 19.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

9. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

10. Claims 1, 2, 4, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. (US PGPub. 2002/0071198, hereafter Liu) in view of Rosenblum et al.

11. Regarding claim 1, Liu shows a hard disk drive (HDD) comprising:

at least one rotatable disk (page 3, right hand column, lines 26-28);

at least one write element (transducer) configured for writing data to the disk (page 3, right hand column, lines 28-30) in isolated tracks (page 6, right hand column, lines 8-13) and in bands, wherein at least two tracks establish a band (plurality of adjacent tracks) (page 6, left hand column, lines 35-52); and

at least one HDD controller controlling the write element (page 7, paragraph 73), wherein segments of data (grouping of data written sequentially) corresponds to a respective band or respective isolated track (page 6, paragraph 67 and paragraph 70) and an embedded file system is used in reading and writing data (page 6, paragraph 69).

However, Liu does not disclose the file system being a log-structured file system with segments.

Rosenblum shows a log-structured file system (page 3, left hand column, lines 36-41 through right hand column, lines 1-2) wherein the file system defines segments for writing groupings of sequential data (page 4, right hand column, lines 14-19).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the log-structured file system of Rosenblum in the disk storage system of Liu such that each segment corresponds to an isolated

track or a band of tracks in order to achieve faster file writing and crash recovery (page 1, left hand column, lines 4-7 and page 9, right hand column, lines 14-30).

12. Regarding claim 2, the combination of Liu and Rosenblum teaches all the limitations of claim 1 as shown above, and Liu shows that at least some bands include at least three contiguous tracks (figure 13 and paragraph 68).

13. Regarding claim 4, the combination of Liu and Rosenblum teaches all the limitations of claim 1 as shown above, and Liu discloses that the tracks within a band (data block) are shingled (figure 13 and page 6, paragraph 68).

14. Regarding claim 10, Liu shows a hard disk drive (HDD) comprising:

disk means for storing data (page 3, right hand column, lines 26-28);

means for writing data to the disk (transducer) (page 3, right hand column, lines 28-30) in tracks (page 6, right hand column, lines 8-13) and in bands, wherein at least two tracks establish a band (plurality of adjacent tracks) (page 6, left hand column, lines 35-52) and wherein at least some bands are shingled (page 6, paragraph 68); and

means for controlling the means for writing (page 7, paragraph 73), wherein an embedded file system is used in reading and writing data (page 6, paragraph 69).

However, Liu does not disclose the file system being a log-structured file system.

Rosenblum shows the use of a log-structured file system for recording sequential data (page 3, left hand column, lines 36-41 through right hand column, lines 1-2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the log-structured file system of Rosenblum in the disk storage system of Liu in order to achieve faster file writing and crash

recovery (Rosenblum, page 1, left hand column, lines 4-7 and page 9, right hand column, lines 14-30).

15. Regarding claim 11, the combination of Liu and Rosenblum teaches all the limitations of claim 10 as shown above, and Liu shows that at least some bands include at least three contiguous tracks (figure 13 and paragraph 68).

16. Claims 3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Liu and Rosenblum as applied to claims 1 and 10 above, and further in view of Payne et al. (US Pat. 6,212,047, hereafter Payne).

17. Regarding claim 3, the combination of Liu and Rosenblum teaches all the limitations of claim 1 as shown above but does not disclose the write element being configured for perpendicular recording.

Payne shows a magnetic disk system wherein the write element is configured for perpendicular recording (column 3, lines 45-62).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the configuration of the write element for perpendicular recording as taught by Payne in the disk system of the combination of Liu and Rosenblum in order to achieve high density storage with good stability on magnetic disk storage (Payne, column 2, lines 3-11).

18. Regarding claim 12, the combination of Liu and Rosenblum teaches all the limitations of claim 10 as shown above but does not disclose the means for writing being configured for perpendicular recording.

Payne shows a magnetic disk system wherein the means for writing is configured for perpendicular recording (column 3, lines 45-62).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the configuration of the means for writing for perpendicular recording as taught by Payne in the disk system of the combination of Liu and Rosenblum in order to achieve high density storage with good stability on magnetic disk storage (Payne, column 2, lines 3-11).

19. Claims 5 and 13 rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Liu and Rosenblum as applied to claims 1 and 10 above, and further in view of Asano et al. (US PGPub 2003/0147167, hereafter Asano).

20. Regarding claim 5, the combination of Liu and Rosenblum teaches all the limitations of claim 1 as shown above but does not show the use of error correction code.

Asano discloses, in a magnetic disk storage system wherein data is written one sector at a time (page 3, paragraph 28), using an error correction code (ECC) block size larger than a physical sector size of the disk, a cumulative ECC parity state between partial writes of an ECC block being retained (page 8, paragraphs 107 and 108).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the ECC structure and operations of Asano in the disk system of the combination of Liu and Rosenblum such that the log-structured file system uses the error correction code in order to provide projection against burst

errors and random errors without incurring the delays of read-modify-write operations when sequentially writing large amounts of data (Asano, page 8, paragraph 107).

21. Regarding claim 13, the combination of Liu and Rosenblum teaches all the limitations of claim 10 as shown above but does not show the use of error correction code.

Asano discloses, in a magnetic disk storage system wherein data is written one sector at a time (page 3, paragraph 28), using an error correction code (ECC) block size larger than a physical sector size of the disk, a cumulative ECC parity state between partial writes of an ECC block being retained (page 8, paragraphs 107 and 108).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the ECC structure and operations of Asano in the disk system of the combination of Liu and Rosenblum such that the log means uses the error correction code in order to provide projection against burst errors and random errors without incurring the delays of read-modify-write operations when sequentially writing large amounts of data (Asano, page 8, paragraph 107).

22. Claims 6-8 and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Liu and Rosenblum as applied to claims 1 and 10 above, and further in view of Ono et al. (US Pat. 5,872,905, hereafter Ono).

23. Regarding claim 6, the combination of Liu and Rosenblum teaches all the limitations of claim 1 as shown above, and Liu shows shingled track writing (page 6, left hand column, lines 35-45). However, the combination of Liu and Rosenblum does not disclose using a virtual address table when writing to the disk.

Ono teaches using a virtual address table (translation table) for accessing a magnetic disk wherein a virtual sector is assigned a replacement sector when a sector originally mapped to the virtual sector is corrupted (column 17, lines 34-44).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the virtual address table of Ono in the disk writing procedure of the combination of Liu and Rosenblum in order to maintain the integrity of the data being stored on a magnetic disk storage apparatus without complicating the logic of the devices accessing the storage apparatus (Ono, column 17, lines 41-50).

24. Regarding claim 7, the combination of Liu, Rosenblum, and Ono teaches all the limitations of claim 6 as shown above, and Ono shows that the VAT (translation table) maps virtual sector locations to actual sector locations (column 17, lines 26-40).

25. Regarding claim 8, the combination of Liu, Rosenblum, and Ono teaches all the limitations of claim 6 as shown above, and Ono discloses that the VAT is stored in a location on the disk (column 17, lines 34-40). Furthermore, Liu shows that the storage locations on the disk consist of a region with non-overlapping tracks where random access writes can be performed, and a region with shingled written bands (page 6, paragraph 67). Additionally, Rosenblum shows that storage operations use a log structured approach (page 3, left hand column, lines 36-41 through right hand column, lines 1-2).

26. Regarding claim 14, the combination of Liu and Rosenblum teaches all the limitations of claim 10 as shown above, and Liu shows shingled track writing (page 6,

left hand column, lines 35-45). However, the combination of Liu and Rosenblum does not disclose using a virtual address table when writing to the disk.

Ono teaches using a virtual address table (translation table) for accessing a magnetic disk wherein a virtual sector is assigned a replacement sector when a sector originally mapped to the virtual sector is corrupted (column 17, lines 34-44).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the virtual address table of Ono in the disk writing procedure of the combination of Liu and Rosenblum in order to maintain the integrity of the data being stored on a magnetic disk storage apparatus without complicating the logic of the devices accessing the storage apparatus (Ono, column 17, lines 41-50).

27. Regarding claim 15, the combination of Liu, Rosenblum, and Ono teaches all the limitations of claim 14 as shown above, and Ono shows that the VAT (translation table) maps virtual sector locations to actual sector locations (column 17, lines 26-40).

28. Regarding claim 16, the combination of Liu, Rosenblum, and Ono teaches all the limitations of claim 14 as shown above, and Ono discloses that the VAT is stored in a location on the disk (column 17, lines 34-40). Furthermore, Liu shows that the storage locations on the disk consist of a region with non-overlapping tracks where random access writes can be performed, and a region with shingled written bands (page 6, paragraph 67). Additionally, Rosenblum shows that storage operations use a log structured approach (page 3, left hand column, lines 36-41 through right hand column, lines 1-2).

29. Claims 9 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Liu, Rosenblum, and Ono as applied to claims 6 and 14 above, and further in view of Holland et al.

30. Regarding claim 9, the combination of Liu, Rosenblum, and Ono teaches all the limitations of claim 6 as shown above, and remapping sectors as required by an access to the disk (Ono, column 17, lines 34-44) wherein accessing the disk includes shingled track writing (Liu, page 6, left hand column, lines 35-45). However, the combation of Liu, Rosenblum, and Ono does not teach the hard disk being part of a RAID system.

Holland shows a RAID system including a RAID controller (figure 1 and column 2, lines 66-68 through column 3, lines 1-6) wherein the RAID controller (I/O Process Manager software run on RAID controller) performs the logical to physical address translation for accesses to a hard disk (column 4, lines 57-61).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a RAID controller and system as taught by Holland using the disk system taught by the combination of Liu, Rosenblum, and Ono in the RAID configuration in order to enable recovery of information stored on a disk in the event of a disk drive failure (column 1, lines 29-31).

31. Regarding claim 17, the combination of Liu, Rosenblum, and Ono teaches all the limitations of claim 14 as shown above, and remapping sectors as required by an access to the disk (Ono, column 17, lines 34-44) wherein accessing the disk includes shingled track writing (Liu, page 6, left hand column, lines 35-45). However, the

combation of Liu, Rosenblum, and Ono does not teach the hard disk being part of a RAID system.

Holland shows a RAID system including a RAID means for controlling (RAID controller **8**) (figure 1 and column 2, lines 66-68 through column 3, lines 1-6) wherein the RAID means for controlling (I/O Process Manager software run on RAID controller) performs the logical to physical address translation for accesses to a hard disk (column 4, lines 57-61).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a RAID means for controlling and RAID system as taught by Holland using the disk system taught by the combination of Liu, Rosenblum, and Ono in the RAID configuration in order to enable recovery of information stored on a disk in the event of a disk drive failure (column 1, lines 29-31).

32. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu in view of Rosenblum and Holland.

33. Regarding claim 18, Liu shows a hard disk drive comprising:

at least one storage disk (page 3, right hand column, lines 26-28);

at least one disk controller controlling reading data from and writing data to the disk (page 7, paragraph 73), wherein the drive controller writes data in shingled bands (data groups) (page 6, paragraph 68) and an embedded file system is used in reading and writing data (page 6, paragraph 69).

However, Liu does not disclose the file system being a log-structured file system.

Rosenblum shows a log-structured file system (page 3, left hand column, lines 36-41 through right hand column, lines 1-2).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the log-structured file system of Rosenblum in the disk storage system of Liu in order to achieve faster file writing and crash recovery (page 1, left hand column, lines 4-7 and page 9, right hand column, lines 14-30).

However, the combination of Liu and Rosenblum does not show a RAID system.

Holland shows a RAID system including a RAID means for controlling (RAID controller **8**) (figure 1 and column 2, lines 66-68 through column 3, lines 1-6) and a plurality of hard disk drives (hard disk drive array) with the RAID controller being coupled to each of the disk drives (figure 1 and column 2, lines 43-51) wherein the RAID means for controlling (I/O Process Manager software run on RAID controller) performs the logical to physical address translation for accesses to a hard disk (column 4, lines 57-61).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a RAID means for controlling and RAID system as taught by Holland using the disk system taught by the combination of Liu and Rosenblum in the RAID configuration in order to enable recovery of information stored on a disk in the event of a disk drive failure (column 1, lines 29-31).

34. Regarding claim 19, the combination of Liu, Rosenblum, and Holland teaches all the limitations of claim 18 as shown above, and Liu shows that at least some bands include at least three contiguous tracks (figure 13 and paragraph 68).

35. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Liu, Rosenblum, and Holland as applied to claim 19 above, and further in view of Payne.

36. Regarding claim 20, the combination of Liu, Rosenblum, and Holland teaches all the limitations of claim 19 as shown above but does not disclose the disk drives being configured for perpendicular recording.

Payne shows a magnetic disk system wherein a disk drive is configured for perpendicular recording (column 3, lines 45-62).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the configuration of disk drives for perpendicular recording as taught by Payne in the RAID system of the combination of Liu, Rosenblum, and Holland in order to achieve high density storage with good stability on magnetic disk storage (Payne, column 2, lines 3-11).

37. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Liu, Rosenblum, and Holland as applied to claim 19 above, and further in view of Asano et al. (US PGPub 2003/0147167, hereafter Asano).

38. Regarding claim 21, the combination of Liu, Rosenblum, and Holland teaches all the limitations of claim 19 as shown above but does not show the use of error correction code.

Asano discloses, in a magnetic disk storage system wherein data is written one sector at a time (page 3, paragraph 28), using an error correction code (ECC) block size larger than a physical sector size of the disk, a cumulative ECC parity state between partial writes of an ECC block being retained (page 8, paragraphs 107 and 108).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the ECC structure and operations of Asano in the disk system of the combination of Liu, Rosenblum, and Holland such that the log-structured file system uses the error correction code in order to provide projection against burst errors and random errors without incurring the delays of read-modify-write operations when sequentially writing large amounts of data (Asano, page 8, paragraph 107).

39. Claims 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Liu, Rosenblum, and Holland as applied to claim 19 above, and further in view of Ono.

40. Regarding claim 22, the combination of Liu, Rosenblum, and Holland teaches all the limitations of claim 19 as shown above, and Liu shows shingled track writing (page 6, left hand column, lines 35-45). However, the combination of Liu, Rosenblum, and Holland does not disclose using a virtual address table when writing to the disk.

Ono teaches using a virtual address table (translation table) for accessing a magnetic disk wherein a virtual sector is assigned a replacement sector when a sector originally mapped to the virtual sector is corrupted (column 17, lines 34-44).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the virtual address table of Ono in the disk writing procedure of the combination of Liu, Rosenblum, and Holland in order to maintain the integrity of the data being stored on a magnetic disk storage apparatus without complicating the logic of the devices accessing the storage apparatus (Ono, column 17, lines 41-50).

41. Regarding claim 23, the combination of Liu, Rosenblum, Holland, and Ono teaches all the limitations of claim 22 as shown above, and Ono shows that the VAT (translation table) maps virtual sector locations to actual sector locations (column 17, lines 26-40).

42. Regarding claim 24, the combination of Liu, Rosenblum, Holland, and Ono teaches all the limitations of claim 22 as shown above, and Ono discloses that the VAT is stored in a location on the disk (column 17, lines 34-40). Furthermore, Liu shows that the storage locations on the disk consist of a region with non-overlapping tracks where random access writes can be performed, and a region with shingled written bands (page 6, paragraph 67). Additionally, Rosenblum shows that storage operations use a log structured approach (page 3, left hand column, lines 36-41 through right hand column, lines 1-2).

43. Regarding claim 25, the combination of Liu, Rosenblum, Holland, and Ono teaches all the limitations of claim 22 as shown above, and remapping sectors as required by an access to the disk (Ono, column 17, lines 34-44) wherein accessing the disk includes shingled track writing (Liu, page 6, left hand column, lines 35-45) and the

RAID controller performs the logical to physical address translation for an access to a disk (Holland, column 4, lines 57-61).

Conclusion

44. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Demura et al. (US Pat. 6,357,030) teaches generating error correction code (ECC) parity data for a version of an ECC block modified by a current write operation by using previously stored ECC parity data .

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tyler Willhite whose telephone number is 571-270-1175. The examiner can normally be reached on 7:30am - 5pm M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Reginald Bragdon can be reached on 571-272-4204. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Tyler Willhite
Examiner
Art Unit 2189

TW
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MANO PADMANABHAN
TC 2100

for

REGINALD BRAILDON